LESSON 5: TESTING THE IDEA

Invention Process Steps: Building and Testing
Grade Level: 3-5
Base Time: 90* minutes *(at least 2 class periods recommended)*

Essential Question

Is my invention prototype working the way I planned?

Lesson Overview

This multi-day lesson (a minimum of 90 minutes is recommended) will guide students through the building and testing process of developing an invention. Using knowledge gained from previous lessons and research, students will be asked to think about the importance of testing when evaluating the function and design of their inventions. They must test their inventions to in order to make improvements, leading to subsequent iterations of the original design. They will record all of their activities, data, and observations in their YIP Inventor's Journals or alternative logbooks as they design, build, test, and their inventions, repeating the cycle several times.

Objective

Students will be able to:

- Identify a specific claim about their invention.
- Test their invention claim/s with their peers through feedback.
- Analyze and apply their feedback to their invention design.

Lesson Standards

Next Generation Science Standards:

- 3-5-ETS1-3

Common Core ELA Standards:

- CCSS.ELA-LITERACY.W 3.1, 4.1,5.1
- CCSS.ELA-LITERACY.W 3.2, 4.2, 5.2
- CCSS.ELA-LITERACY.W 3.5, 4.5, 5.5
- CCSS.ELA-LITERACY.SL 3.1, 4.1, 5.1

Materials

Resources for the Educator

- Video: Dr. Pascha Makes an Invention Box, MIT Lemelson Full Steam Ahead, 2020.
- **Link:** https://www.youtube.com/watch?v=OZZFDIa1-0U, (16:35 minutes).
- Invention Prototype Rubric

Materials for the Student

- YIP Inventor's Journals
- Recycled supplies, art/craft supplies (including scissors, tape of all kinds, and glue)
- Worksheet: Peer Testing Feedback Grid (included in Inventor's Journal)
- Worksheet: Changes to Prototype (included in Inventor's Journal)

Notes for the Educator

It is recommended that this lesson take 2 class periods (a minimum of 90 minutes is recommended).

This is a continuation of Lesson 4 and students will be building and testing their invention prototypes and then making modifications as needed. Students may work in groups and/or individually on these project as you prefer.

The building and testing process will require educator guidance and as much independent work time as possible. Much of the work can be done in class, at home, or in some combination of class and home. Teacher should assign a specific number of hours (we recommend 4-6 hours) to be devoted to design and building. If doing work at home, you may ask students to check in on their progress. Educators are strongly encouraged to allow time for students to connect with them and their peers to ask questions and share ideas for invention improvement. All parts of this process should be documented in the YIP Inventor's Journal or an alternative Invention Logbook (digital or hard copy). Logbooks of some kind are required for submission to the Northern New England Invention Convention and the Invention Convention US Nationals.

Instruction & Activities

DAY 1:

Educator Instruction:

Explain to students that they will have time to build their prototypes. Remind them that as they build they should make note of any changes they make to their original design in the process and record these in their Inventor's Journal.

NOTE: Educators are encouraged to establish class guidelines around time required to work on projects at home, which components, if any, are to be submitted for your review and when submissions are due along the way. You may also want to share Invention Prototype rubric (See Educator Resources) on how inventions are evaluated to help students understand their task and the expectations for the final product.

Activity: Invention Building (20+ minutes as time allows, more time is recommended)

Allow students as much time as possible to build and tinker with their prototypes. About halfway through the class, pause the building session to regroup and have a discussion about testing the design.

Educator Instruction:

Explain to students that once they have a solid prototype, they should begin to test it to see if it works the way they want it to. You may prompt with questions such as:

- How might you go about testing your original design once you build it?
- How will you know to try something different and that you need to make modifications to
- your first design?
- How will you be able to know what modifications you might want to make to your original
- design?
- Why is testing important to the invention process?

Ask students to write down in their journal how they wish to test their invention or what questions they would want to ask a peer who might test it.

Explain to students the value of constructive feedback. What makes feedback helpful? What information would be useful for the inventor.

Note: YIP recommends using the following feedback models. You may wish to explain these models and what you expect of students as they give feedback.

- *TAG Model: **T**ell something you like about it, **A**sk a question about it, **G**ive a suggestion to improve it*
- *Hamburger Model: **Top bun** is a positive comment about it; **Hamburger** is the feedback that will be useful to help improve it; **Bottom bun** is another positive comment about it.*

Activity: Peer Testing (15+ minutes as time allows, more time is recommended)

If working in a team, students should be together as a team during peer sharing so that all group members are involved in the process. Each student should still record the feedback they receive and their ideas for how they might change their design in their own journals so that each student has their own record of the project.

Create a "mix and mingle" activity for the class. Allow students/groups to walk around to share their prototypes and ask peers to test them and provide feedback. Encourage students to provide constructive feedback and positive comments to support the invention process.

Have students complete the Peer Testing Feedback Grid included in the Inventor's Journal to record the feedback received.

For nonworking prototypes:

- Does the prototype accurately represent the solution idea?

For working prototypes:

- Does the prototype work as intended?
- What improvements could be made?
- What about the prototype works well?

Educator Instruction:

Following the peer share, ask the students to consider the feedback they received. What suggestions did people have? How can they use this information to modify and improve their prototype.

If time allows, ask students to complete the Changes to Prototype Worksheet included in the Inventor's Journal. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as Prototype Design #2. You may also choose to have students complete this worksheet at home or at the start of the next class session.

DAY 2:

Educator Instruction

Resume the lesson from the previous class session. Allow more time for building, making changes to the prototype and more testing with peers. Students may continue this cycle several times as time allows. It is recommended that students have at least 2 iterations of their prototype to show the evolution of the invention. You may wish to make more copies of the Peer Testing Feedback Grid that students can use during peer sharing and insert them into their journal.

Ideas for Virtual Instruction

Activity: Invention Building

Ask students to begin to build their invention prototype using materials from home (recycled materials, craft and school supplies, old fabrics and cardboard boxes, etc.) Students may submit photos or updates on their progress using a platform of choice.

Activity: Peer or Other Person Testing

Ask students to ask others at home to test their prototypes and provide feedback. Complete the Peer Feedback Testing Grid included in the Inventor's Journal. Students may submit photos or updates on their progress using a platform of choice.

Activity: Peer or Other Person Testing

Ask students to complete the Changes to Prototype Worksheet included in the Inventor's Journal. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as #2.

Check for Understanding

Educator may wish to do one of the following to check for understanding:

Have students list one thing they plan to change about their invention.

Take Home Assignment

(optional if giving take home work)

Ask students to complete the Changes to Prototype Worksheet. They may write notes about what changes they want to make and why. Then they will draw a new design to show and label it. They should title this design as Prototype Design #2.